



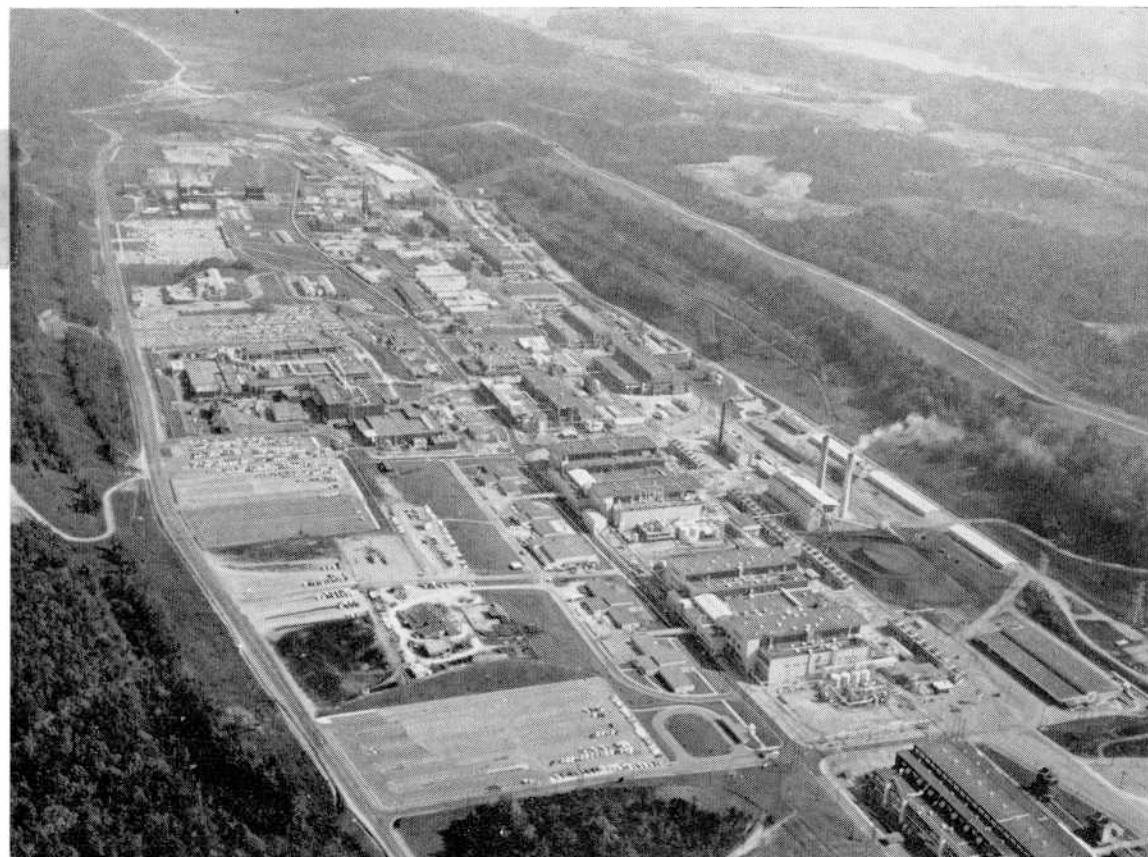
# — Y-12 BULLETIN

A Newspaper For Y-12 Employees of Union Carbide Corporation—Nuclear Division

SPECIAL EDITION

OAK RIDGE, TENNESSEE

July 17, 18, 1965



**AN AERIAL VIEW OF THE Y-12 PLANT AREA** is seen, looking due east. In the right background can be seen part of the shoreline of Melton Hill Lake. The 500-acre plant is nestled in what was and still is called Bear Creek Valley.

## Y-12 Built On Crash Basis As Atomic Age Dawned In History

### Original Purpose Of Plant Was Changed To Meet Changing Nuclear Developments

To understand a little about Y-12, one must study its hectic history. Built during World War II on a crash basis (there wasn't even a pilot plant designed prior to construction), ground-breaking took place in a veil of secrecy on February 1, 1943. Designed originally to separate uranium-235 (the fissionable isotope of uranium) by the electromagnetic process, Y-12's purchase price came high . . . almost a half a billion dollars.

The extremely complicated process was developed by the late Dr. E. O. Lawrence at the Radiation Laboratory at Berkeley. Nearly 23,000 operating personnel worked in Y-12 at that time, (Tennessee Eastman Corporation operated the plant from its beginning until May 4, 1947 when Union Carbide Corporation became the prime contractor.)

Uranium-235 separated at Y-12 was the fissionable material used in the world's first uranium bomb, "Little Boy," which was detonated on August 5, 1945.

After the end of World War II, the electromagnetic isotope separation process was discontinued in favor of the more economical gaseous diffusion process.

#### Plant Retains Old War-Time Code Name Of 'Y-12'

Y-12 is the only Atomic Energy Commission complex left in this area that still maintains its old code name. Oak Ridge National Laboratory was formerly Clinton Laboratories and X-10, and ORGDP was originally named K-25. Many descriptive names have been considered for the plant, but the variety of activities precludes a simple title, so the old code name has stuck.

Since those early war years, Y-12 has been converted into a highly sophisticated manufacturing and development engineering organization, utilizing some of the most advanced techniques and facilities known.

The plant itself staggers the imagination in size . . . about two and one-half miles long and one-quarter mile wide. The combined floor space of the several hundred buildings inside the complex is of the order of 4,500,000 square feet. (More than 78 football fields could be fitted into the complexities of Y-12's buildings!) A lot of this space is under very rigid environmental control.

#### Large Variety Of Intricate Tooling Machines Found

Since Y-12 is basically a materials processing organization, it is equipped with facilities for materials preparation, fabrication, machining, and assembly. Examples include chemical processing equipment, vacuum casting furnaces, to name only a few. There are over 1,500 machine tools located in the plant, ranging in size from a small jeweler's lathe to machines which will handle a piece of over 100 inches in diameter. Many of these tools are designed to work to very high precision, and a number of them are numerically controlled through computer-produced tapes which guide them through their motions. Furthermore, quite a few have been equipped to machine reactive or toxic materials.

There are approximately 4,500 personnel in Y-12, including 500 scientists and engineers, as well as 1,200 to 1,500 skilled craftsmen. These people, together with the necessary supervisory and supporting employees, operate a variety of facilities to accomplish the programs assigned by the AEC. This combination of skilled people and modern facilities is currently being applied to four major responsibilities.

The first, of course, is our production responsibility in the field of nuclear weapons. This highly classified work is of vital importance to our nation's defenses.

#### Fabrication Support To Other AEC Installations

Secondly, Y-12 acts in the capacity of fabrication support of the weapon design laboratories: The Los Alamos Scientific Laboratory at Los Alamos, New Mexico; the Lawrence Radiation Laboratory, Livermore, California; and the Sandia Corporation, Albuquerque, New Mexico, and Livermore, California. In support of these activities, Y-12 produces components for test devices that are fired—including Plowshare devices for the peaceful use of atomic explosives. In addition, a large amount of the experimental hardware required by these organizations is made here. We also conduct a substantial amount of development for the laboratories.

The third major mission is the support of the Oak Ridge National Laboratory, one of the nation's leading research centers. There are about 900 ORNL employees located in Y-12. These scientists and engineers work for the Biology Division, the Reactor Division, the Thermonuclear Division, and the Isotopes Division. In addition to the usual housekeeping and maintenance services, we supply the facility engineering required by these groups. A large amount of specialized fabrication work is done for the Laboratory. For instance,

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## Y-12 Milestones

- 1943—Ground was broken for the first building on February 1, 1943. Chemical operations for electromagnetic separator charge preparation began October of that year, and the first electromagnetic separator was started up in November.
- 1944—The first production building went into operation on January 27, and conversion of highly enriched uranium-235 to UF<sub>4</sub> began in November.
- 1945—Uranium recovery began in January. On September 22, all electromagnetic separators went into production to produce low-level enriched U-235 were shut down, since the Oak Ridge Gaseous Diffusion Plant was supplying a sufficient amount of partially-enriched feed for the production-level electromagnetic separators.
- 1946—All magnetic separators were discontinued as production units on December 23.
- 1947—Union Carbide Corporation replaced Tennessee Eastman as operating contractor on May 4. Enriched uranium-235 produced by the gaseous diffusion process was reduced to metal and fabricated at Y-12 in accordance with AEC requirements.
- 1948—Machining of enriched uranium on a small scale was started early in the year.
- 1950—Hafnium-free zirconium production was started in January for use in the Naval Reactor program. The casting and machining

of uranium-aluminum alloy and the first large-scale precision machining of beryllium began.

1953—Additional uranium casting facilities and another uranium machining shop were installed and completed. A hydraulic pressing facility was added in October.

1954—An expansion of the enhanced-uranium salvage facility was completed early in the year.

1955—Installation of additional uranium casting facilities was completed.

1956—An accelerated program of providing technical information and assistance to industry interested in uranium salvage and recovery operations began.

1957—Installation of a Primary Rolling Mill and further pressing facilities for fabricating uranium were completed.

1958—Installation of a heavy machine shop for uranium fabrication was completed. A second rolling mill for uranium was installed.

1959—Development and special fabrication service in pressing and machining of tungsten was provided for the missile program. AEC announced public sale of highly enriched lithium-7.

1960—Specialized development and preproduction fuel element fabrication for the nuclear-powered rocket (ROVER) program started in August.

1962—AEC authorized Y-12 to provide specialized fabrication service for a missile nose cone.

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## 'Welcome To The Y-12 Plant'

It is with great pleasure that I welcome you to the Y-12 Plant. This is the first time in our 22-year history that families have been invited to visit any of our working areas.

We are proud of the things we accomplish here . . . proud of our part in our nation's defense, and proud of the versatility of our skilled, talented employees; their pride of workmanship is our greatest asset.

The Development Division has provided for us a most interesting tour and display. Although you are seeing only an unclassified portion of our work, I am sure that what you see will enhance your appreciation of what we undertake here and let you also, as members of the family, take pride in our accomplishments.



**ROGER F. HIBBS**

Plant Superintendent

# Exhibits Show Wide Range Of Plant Activities For Y-12ers

Following is a brief description of Family Day — Y-12 activities. You will probably want to keep this special issue of the Bulletin as a memento, it will help you remember some of the high-lights of what you saw.

The information desk is in the Main Lobby (A on the Map). There a hostess provides you with descriptive material to make your visit more informative. At B & C — (in the High Temperature Laboratory) you view the Y-12 Plant Story, and the Development Story . . . slide shows giving highlights of the plant's and Development Division's activities.

## Exhibit D

Y-12 is extremely proud of its illustrious safety record. Using the theme "Y-12 is a Safe Place to Work" this display shows Y-12's safety performance compared to all of Union Carbide Corporation, to other Atomic Energy Commission plants, to other chemical industries, and to industry as a whole.

Y-12's "Safety Policy" is simply stated: "It is the policy of the Y-12 Plant to establish an effective accident prevention program and to maintain the necessary staff, service, and advisory groups to assist line supervision who are responsible for the safety of employees and equipment. Whenever our safety objective conflicts with other objectives, safety shall be our first consideration."

Various safety achievement awards are exhibited. Safety equipment provided for employees is also displayed. The achievement awards included are those of the Union Carbide Corporation special recognition, National Safety Council awards, the Atomic Energy Commission citations, and the James H. Holmes Association awards.

Safety pamphlets, free literature, and a picture postcard of the Y-12 Plant are available here.

## Exhibit E

**MATERIALS EXHIBIT** — The Y-12 Plant handles a surprisingly large number of chemical elements in many forms. This exhibit contains a periodic chart of the elements with those lighted that are handled here. In addition, samples of some of the unusual and most commonly handled materials are displayed: for instance metals, ceramics, plastics, and carbon.

For each category of materials, a simple demonstration or action display is used to illustrate a property that makes the materials useful in our work. The wide range of densities available in metals is illustrated by comparing the very light beryllium and the heavy uranium. Ceramics are shown to be good insulators. For carbon, resistance to thermal shock is shown by heating the end of a graphite rod with a torch and then plunging it into liquid nitrogen. The wide variation of flexibility possible in plastics is illustrated.

## Exhibit F

**Y-12 PLANT MILESTONES** — This exhibit describes significant steps in the development of Y-12. It begins with the 1943 ground-breaking and ends with a general



**PROJECT GNOME** was the first nuclear detonation under the Plowshare Program. In a chamber 1,200 feet below the earth's surface a 3.1 kiloton device was exploded. The major components in this device were fabricated in Y-12.

description of some of the present-day activities. The ground-breaking portion of the exhibit includes an actual calutron subassembly of the type used to separate (electromagnetically) uranium-235 from normal uranium. The present-day portion of the exhibit includes a description of Y-12's supporting contribution to peaceful and defensive applications of nuclear explosives. This portion also describes the supporting role of Y-12 in the nuclear space vehicle program. Sandwiched between these two extreme portions of the exhibit is a description of such milestones as:

- 1945—Y-12 supplied U-235 for "Little Boy," the first uranium bomb.
- 1947—Y-12 was assigned a new role involving uranium reduction and fabrication. (A machined piece of uranium is shown with this exhibit.)
- 1950—A process for producing hafnium-free zirconium, a material to be used in atomic propulsion reactors, was developed by Y-12.
- 1953—New technology development began with the establishment of isotatic pressing facilities at Y-12.
- 1958—New and revised equipment for processing many different materials was added at Y-12.

## Exhibit G

### PROJECT GNOME

Project Gnome was a nuclear detonation conducted under the Atomic Energy Commission's Plowshare Program for development of the peaceful uses of nuclear explosives. Y-12 fabricated major components for the device used in this test. The experiment involved the detonation in 1963 of a 3-kiloton nuclear explosive in a chamber 1,200 feet below the earth's surface in the Salado Salt

Basin, near Carlsbad, New Mexico.

The display (supplied by the Sandia Corporation, Albuquerque, New Mexico) is a diorama including a cut-away view of the test area. A sample of the salt from the test hole, an air pressure gage, and a horizontal velocity gage are shown.

### PROJECT SEDAN

There is a continuous showing of a motion picture film entitled, **PROJECT SEDAN**. SEDAN was part of the Atomic Energy Commission's program to establish the feasibility of nuclear excavation of harbors and canals. The specific objective was to determine the cratering and radioactivity-entrapment effects of detonating a 100-kiloton nuclear device buried in the Nevada desert. The crater produced was 1,200 feet across and 320 feet deep. It would take one man with a pick and shovel more than 6,000 years to dig a hole this size.

Y-12 manufactured major components for the device used in this test.

## Exhibit H

### CHEMICAL ENGINEERING SYSTEMS

**Liquid-liquid extractions** — A pair of pulse columns, familiar to Y-12 employees for many years, is shown in this display. The exhibit illustrates an important application of chemical engineering which has made many nuclear materials available at a relatively low cost.

Y-12 has been a pioneer in the use of pulse columns and has made important contributions toward the development and use of this technique.

## Exhibit I

### PREPARATION OF CHEMICAL COMPOUNDS

Fluid beds have played a significant role in Y-12's chemical technology. Therefore, an operating model of one is in this exhibit.

It is part of an exhibit called "Y-12's Chemical Engineering Technology Develops Chemicals for Nuclear Applications." Examples of many chemicals worked with at Y-12 include those used to produce fuel elements for past, present and future reactors.

A process for producing uranium metal "slugs" as used in the past generation of reactors is displayed. Production of UO<sub>2</sub> pellets for the Experimental Gas Cooled Reactor exemplifies present technology. For the future reactors, the manufacture of fuel elements capable of very high-temperature operations is depicted.

In addition to the processing operations, samples of green salt, yellow cake, and pyrolytic carbon-coated uranium dicarbide are displayed.

## Exhibit J

### METALLURGY

This exhibit portrays the role of metallurgy in Y-12. Panels explain how alloying can change the properties of materials, both for the betterment or detriment of the original material. Other panels show the steps in making uranium products, and how to make parts by powder metallurgy. The final display shows metals as seen under a microscope.

Actual demonstrations show how aluminum can be melted while suspended in the air and how the hardness of metals is measured.

## Exhibit K

The development of metal-working processes from the dawn of history to modern times is traced in a panorama of large color photographs. Y-12's participation in a variety of fields is shown in photographs of actual equipment fabricated for reactors, space vehicles, missile components and other space-age programs.

Two modern machine tools are in actual operation. A numerically controlled drilling machine "goes through its paces" commanded entirely by a one-inch-wide punched paper tape, and a high-production automatic screw machine makes novel souvenirs.

## Exhibit L

### PRODUCT FABRICATION

The Production Certification Exhibit depicts the role of testing and inspection in plant production. Actual operating equipment from various sections is demonstrated. This equipment includes an ultrasonic flaw detector, an automatic air monitor, an automatic laser-interferometer calibrator, and an electronic comparator. Visitors are able to examine a material sample using the hand-held transducer of the ultrasonic flaw detector. Defects in the material are displayed as spikes on the oscilloscope tube.

The automatic air-sample analyzer is in continuous operation. With this device, the round filter disks are placed in a rack at the top of the machine and disks from the stack are individually processed through two checking stations and restacked. Simultaneously, the results are punched in data cards.

The laser-interferometer display consists of a laser calibrator and a measuring machine. As the measuring machine slide is displayed, the amount of displacement is displayed on the interferometer console. The laser supplies a highly coherent single-frequency light source for calibrating distances up to 100 inches with an accuracy of 0.00001 inch.

The electronic comparator is adjusted to show deviations in the thickness of a piece as the piece is moved between the instrument anvil and the sensing head.

Photographs of representative equipment used by the Physical Testing Laboratory, and Dimensional Measurement Groups are displayed on the walls.

## Exhibit M

"From Ideas to Reality" is the theme of an exhibit graphically illustrating the coordination necessary to carry a project from concept to completion. The project described is fabrication of the blood experiment package known as "BIG-I," which was aboard the Gemini-3 flight on March 23, 1965. The project was a cooperative venture between ORNL Biology Division, which designed the experiment, and the Y-12 Plant, which designed and fabricated the sophisticated instrumentation and hardware. Successful completion of this job required the combined efforts of many groups in Y-12; including Development, Engineering, Fabrication, and Maintenance.

Some of the highlights seen in this display are (1) beautiful color photographs of different stages of the blast-off and recovery operations; (2) the smallest light bulbs in the world; (3) other small parts used in the package; (4) the prototype package which includes the failures and successes of the designers' first efforts; (5) special tools which include a soldering technique using gold encapsulated solder balls smaller than the naked eye can see; (6) last, but not least, the actual Big I Package which made the flight with the astronauts.

# Development Division Provides Essential Support To Plant Activities



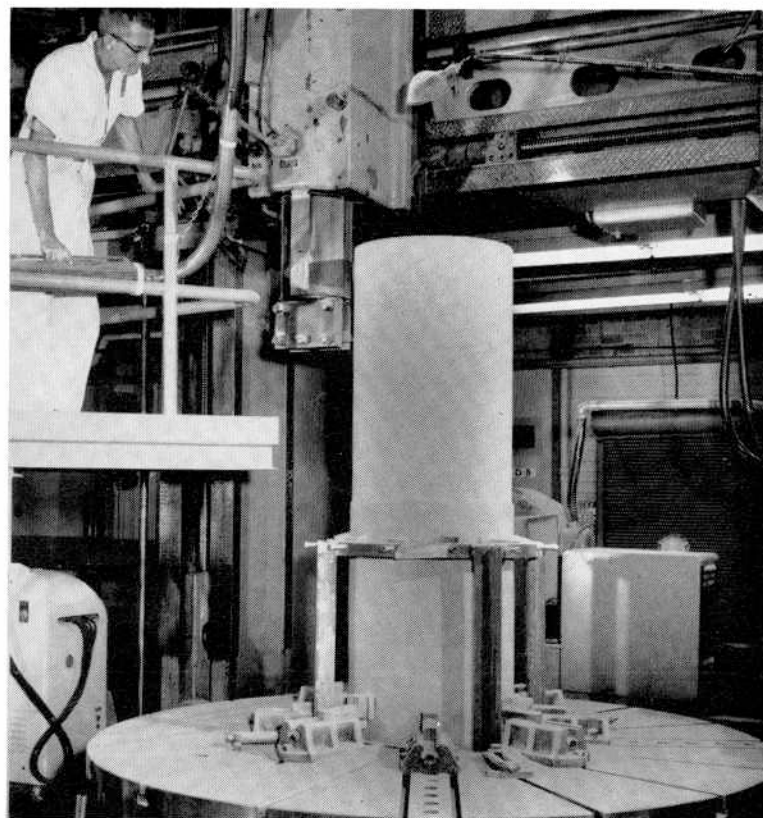
**CHEMICAL ENGINEERING DEVELOPMENT DEPARTMENT** — This large-scale facility for the recovery of enriched uranium by solvent extraction is a typical product of chemical engineering design. (The cost of enriched uranium is so great that its recovery is mandatory. Elaborate recovery schemes have long been a part of the atomic energy program.)

## Six Major Groups Comprise Efforts

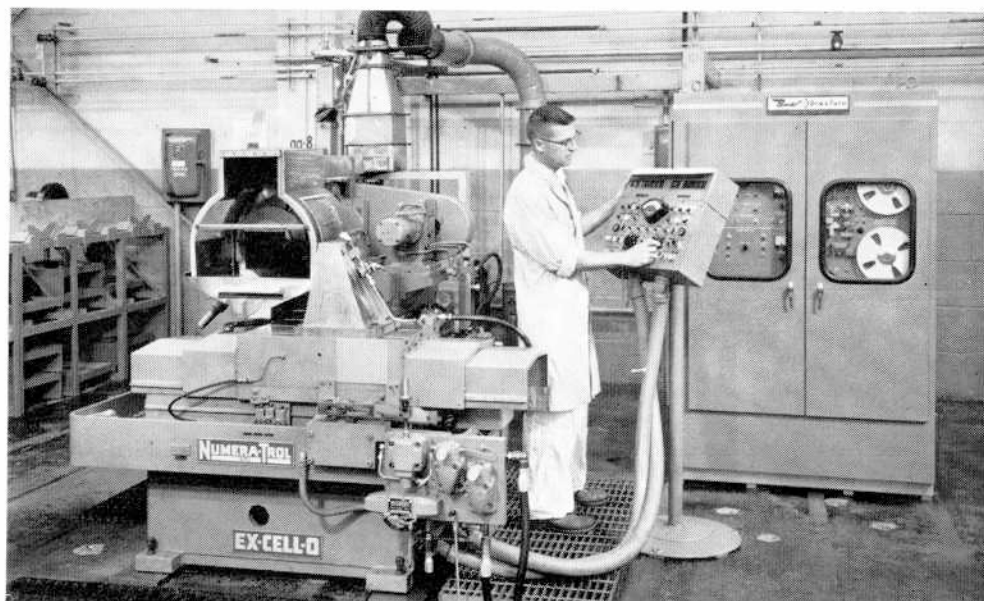
The scientific, technical and industrial skills available in Y-12's Development Division, combined with modern facilities and equipment, provide essential support to the plant's varied research and production activities.

Development work for other government programs is also undertaken by the Division at the request of the Atomic Energy Commission and other government contractors.

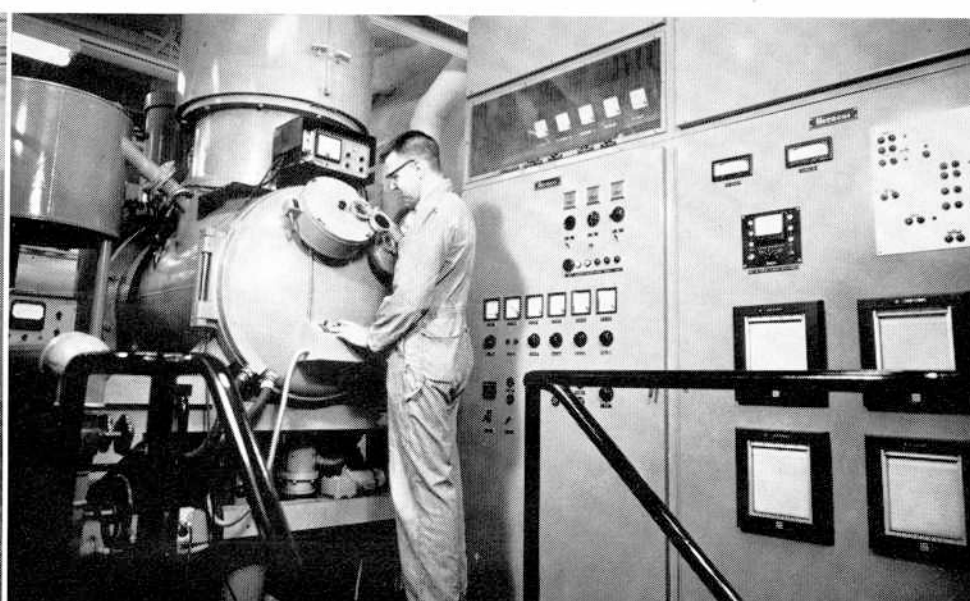
The Division is staffed with nearly 200 professional, technical and clerical personnel to solve the complex problems encountered in such areas as metallurgy, special fabrication, chemistry, chemical engineering, materials research, and product or process development. The division is organized into six departments: Ceramics and Plastics, Chemical Engineering, Chemistry, Mechanical, Metallurgical, and Laboratory Development. Each has its own major field of endeavor, yet all work together with one another and with other divisions in the Plant. Some examples of the contributions made by these six departments are shown in the accompanying photographs.



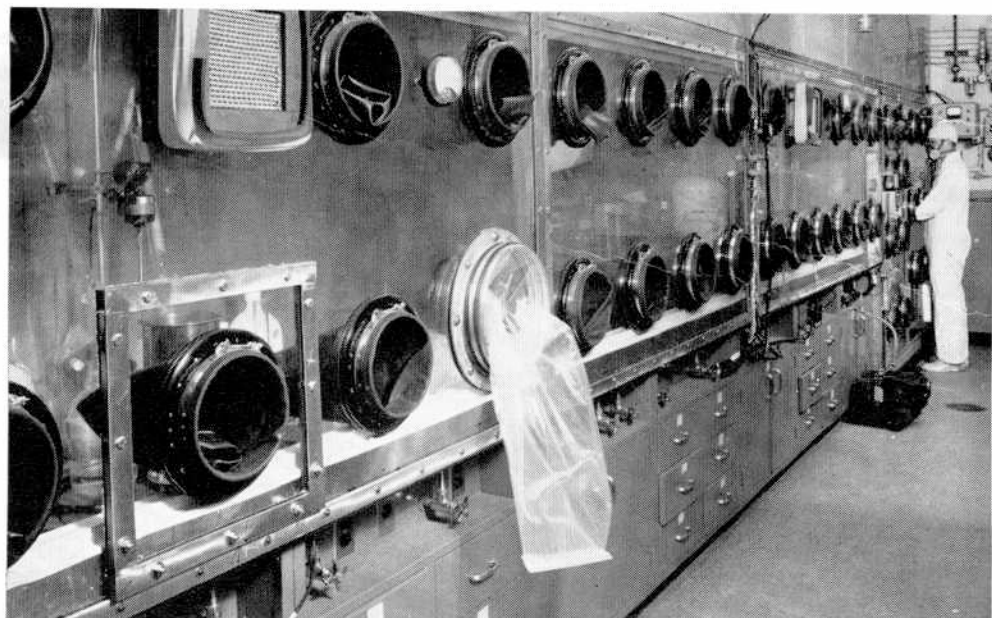
**CERAMICS AND PLASTICS DEPARTMENT** — Some of the country's largest monolithic ceramic structures are fabricated by isostatic pressing at Y-12 under the guidance of ceramic engineers in the Development Division. Large aluminum oxide cylinders such as this are used as insulators in the C Research Stellarator at Princeton University.



**MECHANICAL DEVELOPMENT DEPARTMENT** — This department supports activities in the field of machine tool design, development, and operation. This numerically controlled-continuous path turning lathe is typical of the advanced production machine tools used at Y-12.



**METALLURGICAL DEVELOPMENT DEPARTMENT** — Improving the techniques of metal working — melting, casting, joining, rolling, forming, etc — is a major responsibility. This electron-beam furnace is a recent addition to the varied equipment now available to our metallurgists.

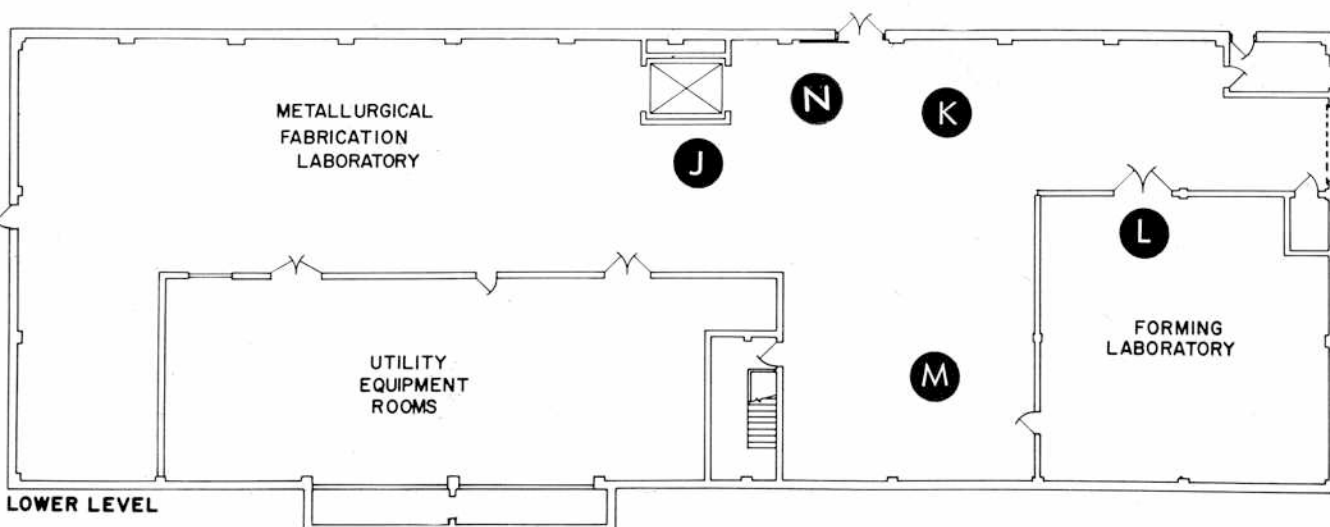
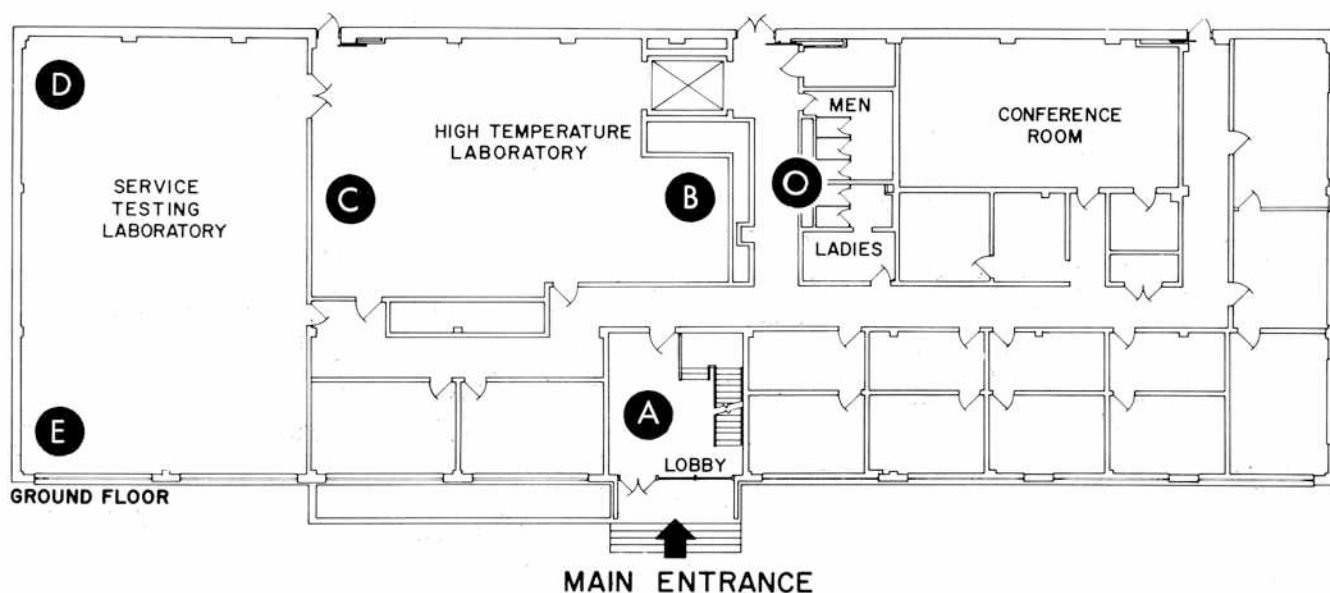
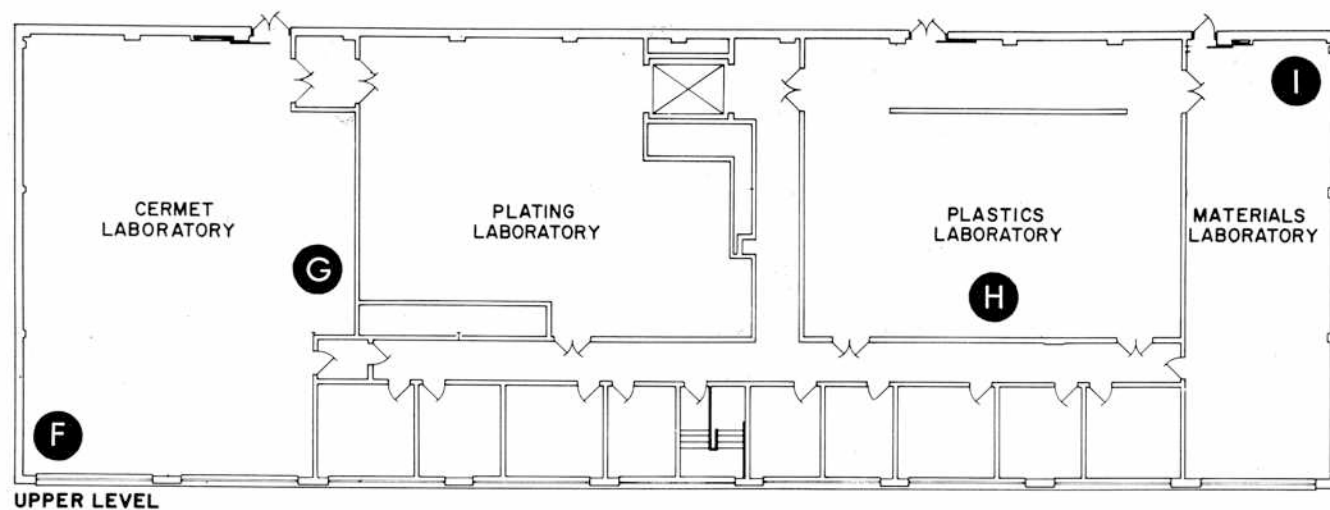


**CHEMISTRY DEVELOPMENT DEPARTMENT** — Chemical development at Y-12 means developing a process all the way from concept through pilot production — often with hazardous and reactive materials. Controlled-atmosphere enclosures such as this, where the operator works through glove ports, are an important part of the equipment.



**LABORATORY DEVELOPMENT DEPARTMENT** — Measurement, testing, and instrumental analysis are the concern of this department. An example is the anechoic (non-reflecting) room for exploring non-contact measurement techniques with high-frequency sound.

# Detail Map Of Family Day Tour



## EXHIBITS

- A REGISTRATION AND INFORMATION
- B THE Y-12 PLANT STORY
- C THE DEVELOPMENT STORY
- D SAFETY AT Y-12
- E Y-12 MATERIALS
- F Y-12 MILESTONES
- G PROJECTS GNOME AND SEDAN
- H CHEMICAL ENGINEERING SYSTEMS
- I PREPARATION OF CHEMICAL COMPOUNDS
- J METALLURGICAL PROCESSES
- K MECHANICAL FABRICATION
- L PRODUCT CERTIFICATION
- M FROM IDEAS TO REALITY
- N START OF ESCORTED TOUR THROUGH DEVELOPMENT FACILITIES
- O REST ROOMS

## Y-12 Built On Crash Basis As Atomic Age Dawned . . .

Continued from Page 1

Y-12 fabricated major components for the Molten Salt Reactor Experiment, the High Flux Isotope Reactor, the DCX fusion experiment, and the Oak Ridge Isochronous Cyclotron.

### Research Keeps Y-12 In Forefront Of Our Specialties

The fourth mission of the plant is the maintenance of a research and development program in support of the primary mission. This work is divided into the categories of enabling research, that is, finding out how to accomplish the production requirements on an economical scale, the trouble shooting required to support the plant, and the speculative research necessary to keep us in the forefront of our specialties.

Because of the Plant's vast re-

servoir of industrial and scientific skills, many problems have been brought to Y-12 that are not related to weapons. Problems involving chemistry, engineering, metallurgy and fabrication developments are often solved here. Noteworthy among our achievements are the production of fuel elements for the nuclear rocket program, some tungsten inserts for Polaris rockets, exotic material items, biomedical engineering assistance, and solution of space-related problems.

The AEC has said of Y-12: "The capability and versatility of Y-12 are now proven assets to the United States nuclear energy effort. As the highly-skilled personnel of Y-12 continue to perform difficult production and engineering jobs, frequently on lightning

### REASONS FOR OAK RIDGE

The 92-square mile area chosen for Oak Ridge by a team of Army's Manhattan Engineer District officers and Stone and Webster Corporation men was picked for several reasons. Its isolation, availability of water, power and transportation, and the labor surplus in the region all contributed to the choice.

### CLOSED CITY

The Oak Ridge area, from its wartime beginning until 1949, was under tight security with access rigidly controlled. In March, 1949, the community portion was opened to the public, and the security fences were pulled back to encompass a controlled area of 35,000 acres in which the major installations were located.

schedules, they add immeasurably to the nation's defense posture while at the same time advancing the peaceful application of the atom."

## For Best Effect See Exhibits As Coded In Alphabetical Order

Above is a map of the new development buildings, showing the location of specially prepared exhibits and displays. You are invited to inspect these displays and the several laboratories, taking whatever time you wish at each stop. It is suggested that many want to visit the exhibits in alphabetical order. If you do this, the last stop will be station "N" which is the starting point for the escorted tour through other development laboratories and facilities.

If, at any time you need information or assistance, ask any exhibit attendant, hostess, or tour guide. In case of emergency, simply pick up any telephone and dial 3-7172.

## More Y-12 Milestones

Continued from Page 1  
1963-1965—During this period Y-12 fabricated radiation shields for the SNAP Program, made high-temperature-resistant ceramic tubes for controlled fusion experiments, cast pure gold collimators for medical diagnostic equipment, rolled

uranium to 10-mil thickness, precision machined reactor components, prepared seismographic gauges to measure the intensity of underground blasts, and designed and fabricated a unit to irradiate blood samples aboard a Gemini flight.